

U.S. Patent Application Serial No. 10/661,554
Amendment filed February 2, 2005
Reply to OA dated November 4, 2004

REMARKS

Claims 1-12 are pending in this application. Claim 1 has been amended herein.

Claims 1-6 are rejected under 35 U.S.C. §102(b) as being anticipated by Biomacromolecules 2001, 2, 70-29, Shen et al.

Reconsideration of the rejection is respectfully requested in view of the amendment to claim 1, which clarifies the structure of the block units recited in claim 1. Applicant submits that this amendment clarifies the difference in structure between the copolymers of the present claims and those of Shen et al.

Support for the amendment to claim 1 can be found in the present specification page 4, lines 1-5. The copolymer of the present invention after the amendment is a block copolymer that has a linear poly(ethylene imine) block unit and a linear poly(N-propionylethylene imine) block unit. As will be discussed below, the structures of the copolymer of claim 1 and that in Chen et al. can be illustrated schematically as follows:

[Schematic diagram of copolymer of claim 1] —aaaaaaa-ccccccc—

[Schematic diagram of Chen et al.] —acaccacacaaca—

where a is the N-propionyl ethyleneimine unit, c is the ethylene imine unit.

That is, each block unit of the present invention is a linear array of the same individual units, while in Chen et al, the distribution of the two types of individual units is random. In the present

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invention, the poly(ethylene imine) block and the poly(N-propionylethylene imine) block copolymers are bonded in the pattern of A-B, A-B-A, B-A-B, or A-B-A-B, as discussed on page 4, lines 6-9, of the specification.

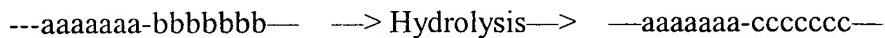
The differences in structure of the copolymer of the present invention and the copolymer of Chen et al. may also be understood from the different preparation methods of these copolymers. The linear structure of the blocks in the present invention may be seen in the Examples of the present specification. Synthesis Examples 1 to 5 (pages 17-20) are of Block Precursors. These are described in general in the present specification on page 7.

The preparation of the block copolymer of the present invention may be summarized as follows. First of all, the water-soluble block copolymer having, in a molecule, a poly(N-formylethylene imine) block unit or a poly(N-acetylethylene imine) block unit, and a poly(N-propionylethylene imine) (this is soluble in water but more easily soluble in organic solvents that are water-incompatible) block unit is dispersed in a solvent mixture of water and an organic solvent which is not compatible with water and in which poly(N-propionylethylene imine) is soluble. When an organic solvent which is incompatible with water but in which the poly(propionylethylene imine) block is soluble is added to an aqueous solution of the block precursor having a molecular chain comprising a formylethylene imine block or an acetylethylene imine block, and a propionylethylene imine block, and then agitated, the formylethylene imine block or the acetylethylene imine block is dissolved in the aqueous phase, and the propionylethylene imine block is dissolved in the organic solvent phase, forming an emulsion.

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By adding acid or alkali to this system, the formylethylene imine block or the acetylethylene imine block dissolved in the aqueous phase are preferentially hydrolyzed, and as a result, it is possible to obtain a water-soluble block copolymer having a linear chain comprising an ethylene imine block and a propionylethylene imine block. The schematic diagram is shown as follows.

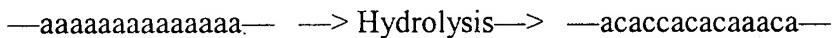
[Schematic diagram of preparation method of the present invention]



(a: N-propionyl ethyleneimine unit, b: N-formylethylene imine unit or N-acetylethylenimine unit, c: ethylene imine unit).

On the other hand, in Shen et al., the arrangement of the a and c units is random. Shen's general preparation scheme can be summarized as follows:

[Schematic diagram of Shen et al.'s preparation method]



(a: N-propionyl ethyleneimine unit, c: ethylene imine unit).

Here, partial hydrolysis of a to c yields the random arrangement of the units.

For example, poly(ethyloxazoline-co-ethyleneimine-co-pentadecanyloxazoline) is disclosed in Fig.2 (page 71, right column), and page 71, left column, paragraph 2; page 71, right column, paragraph 3; and page 74, left column, paragraph 1, of Shen et al.

However, as noted above, in the copolymer described in Shen: "The PEOX was first partially hydrolyzed to render a copolymer with both ethyloxazoline and ethyleneimine units" (page 71, right column, lines 11-24, emphasis added). That is, since polymer is made by partial

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hydrolysis and then amidation by active ester chemistry, the arrangement of the units in Shen's polymer is **random**, not block.

Therefore, the copolymer of PEOX-PEI disclosed by Shen et al is a random copolymer, which consists of the ethyloxazoline unit, the ethyleneimine unit and the pentadecanyloxazoline, as shown in Fig. 2 of the reference, in which the subscripts "m", "n" and "o", only show the composition ratio of the units of the random copolymer.

Applicant further notes that there is no suggestion in Shen et al. for the structure of the present invention. The structural difference between Shen's copolymer and that of the present invention leads to significant differences in chemical properties. Since each unit is arbitrarily arranged in the random copolymer of Shen et al., the characteristic of the present invention (block copolymer) of forming the nano association of having the core-corona layer is not found in Shen et al. Shen et al. does not suggest achieving this effect.

Applicant therefore submits that independent claim 1 is novel and non-obvious over Chen et al. Moreover, the limitations of the dependent claims further distinguish these claims from Shen et al.

Claims 2, 3, 5 and 6 recite block copolymers in which X, the residue of a monovalent or greater polymerization initiator, is in the general formula. In the present specification this may be, for example, the alkyl of a chloroalkyl, etc, as disclosed on page 5 of the specification. There appears to be **no analogue of residue X** in the polymers in Shen et al.

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In addition, claim 4 specifically recites a molar ratio of block units. Again, there are no block units in Shen et al.

Applicant therefore asserts that claims 1-6 are novel and non-obvious over Shen et al.

Claims 7-12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Reconsideration of the objection to claims 7 and 8 is respectfully requested in view of the amendment to base claim 1 and the above remarks concerning the rejection of claim 1. The objection to claims 9-12 is respectfully traversed, as claim 9 is an independent claim.

In view of the aforementioned amendments and accompanying remarks, the claims, as amended, are in condition for allowance, which action, at an early date, is requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned agent at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

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In the event that this paper is not timely filed, Applicant respectfully petitions for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

ARMSTRONG, KRATZ, QUINTOS, HANSON & BROOKS, LLP



Daniel A. Geselowitz, Ph.D.

Agent for Applicant

Reg. No. 42,573

DAG/plb/lrj

Atty. Docket No. **031149**
Suite 1000
1725 K Street, N.W.
Washington, D.C. 20006
(202) 659-2930



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